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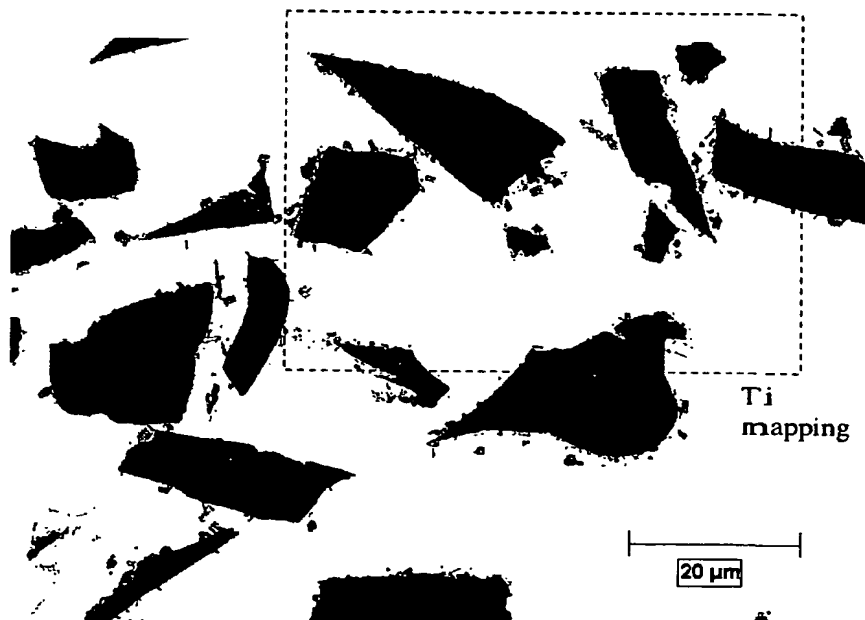
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[Continued on next page]

(54) Title: IMPROVED ALUMINUM ALLOY-BORON CARBIDE COMPOSITE MATERIAL



(57) Abstract: A cast composite material is prepared by furnishing an aluminum-based matrix alloy and forming a mixture of free-flowing boron carbide particles and the aluminum-based matrix alloy in molten form which is stirred to wet the matrix alloy to the boron carbide particles and to distribute the particles throughout the volume of the melt. The molten mixture is then cast. The fluidity of the molten mixture is maintained by (a) maintaining the magnesium content of the matrix metal below about 0.2 % by weight, or (b) starting with a matrix metal containing less than 0.2 % by weight magnesium and adding further magnesium to the mixture a short time before casting, or (c) having at least 0.2 % by weight titanium present in the mixture.



European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

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# INTERNATIONAL SEARCH REPORT

International Application No

/CA 03/01624

A. CLASSIFICATION OF SUBJECT MATTER  
IPC 7 C22C1/10 B22D19/14

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
IPC 7 C22C B22D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, COMPENDEX

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No
X	LUCAS, STEPHENS, GREULICH: "The Effect of Reinforcent Stability on Composition Redistribution in Cast Aluminium Metal Matrix Composites" MATERIALS SCIENCE AND ENGINEERING, no. A131, 1991, pages 221-230, XP002270490 usa abstract page 222, column 2 page 223, column 1 tables 1, AND, 2 --- -/-	1, 12, 14-16, 18, 19, 24, 26-33

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

### \* Special categories of cited documents:

- \*A\* document defining the general state of the art which is not considered to be of particular relevance
- \*E\* earlier document but published on or after the international filing date
- \*L\* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- \*O\* document referring to an oral disclosure, use, exhibition or other means
- \*P\* document published prior to the international filing date but later than the priority date claimed

- \*T\* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- \*X\* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- \*Y\* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- \*Z\* document member of the same patent family

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6 May 2004

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International Application No

/CA 03/01624

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 786 467 A (SKIBO MICHAEL D ET AL) 22 November 1988 (1988-11-22) The whole document. column 3 -column 4 column 5, line 27 - line 41 column 8, line 35 column 9, line 3 - line 7 ----	1-5, 18-21
X	KENNEDY, BRAMPTON: "The Reactive Wetting and Incorporation of B4C Particles into Molten Aluminium" SCRIPTA MATERIALIA, no. 44, 2001, pages 1077-1082, XP002270491 Uk See introduction and Experimental Procedure. page 1077 -page 1078 table 1 ----	24,30,33
A	US 5 186 234 A (SKIBO MICHAEL D ET AL) 16 February 1993 (1993-02-16) The whole document. ----	1-33
A	CHERNYSHOVA, REBROV: "Interaction Kinetics of Boron Carbide and Silicon Carbide With Liquid Aluminium" JOURNAL OF THE LESS COMMON METALS, no. 117, 1986, pages 203-207, XP002270492 Russia The whole document. ----	1-33
A	US 5 965 829 A (OSCHMANN EDWARD L ET AL) 12 October 1999 (1999-10-12) The whole document. -----	1-33

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Information on patent family members

International Application No

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# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/CA 03/01624

## Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:  
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this International application, as follows:

see additional sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

### Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☒ No protest accompanied the payment of additional search fees.

**FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210**

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claim : 1

Claim 1 defines in the preamble a method of making cast Al-based metal matrix composite material by melt stirring 10-40% wt. boron carbide particles into the melt before casting.

The said method is further defined in three different ways which are not unified by a single inventive concept as required by Rule 13(2) PCT for the reasons given below:

Claim 1(a) the Mg content of the matrix alloy is kept below 0.2% (wt).

2. Claim : 1

Claim 1(b) the Mg content of the starting material is kept below 0.2% (wt). Further additions of Mg are added prior to casting.

3. Claim : 1

Claim 1(c) the matrix alloy contains at least 0.2% (wt) Ti.